R&D Investments and Tax Aggressiveness, focus on Biotechnology Firms

Sotiris Gkegkas

SCHOOL OF ECONOMICS, BUSINESS ADMINISTRATION & LEGAL STUDIES

A thesis submitted for the degree of

Master of Science (MSc) in International Accounting, Auditing and Financial Management

May 2020

Thessaloniki – Greece

Student Name: Sotiris Gkegkas

SID: 1107170008
Supervisor: Prof. Alexandros Sikalidis

I hereby declare that the work submitted is mine and that where I have made use of another's work, I have attributed the source(s) according to the Regulations set in the Student's Handbook.

May 2020
Thessaloniki - Greece

Abstract

This dissertation was written as part of the MSc in International Accounting, Auditing & Financial Management at the International Hellenic University.
This dissertation will try to examine the behavior of a biotech firm related to the accounting treatment of Research and Development (therefore R&D) expenses for Tax Avoidance or Tax Aggressiveness reasons)/ benefits. During this thesis I will try to answer to a major hypothesis, are biotech firm using R&D expenses for Tax Aggressiveness reasons. The regression model I will use is the OLS Model.
The dissertation is composed from five (5) major capitals. First Capital is Introduction, where I will try to describe the summary of my thesis, the model and data structure, literature review. In the second chapter I will focus more on the methodology research, by explaining more the basic variables and the construction of the regression model. In the next chapter I will try to explain and present the outcomes of the methodology research and finally at the last chapter Conclusions I will comment on the outcomes and complete the thesis.
At this point I would like to thank my supervisor Dr Alexandros Sikalidis for his valuable help, without which I would not have been able to complete this dissertation.
Next I would like to thank all my Professors in the MSc, who helped me to gain knowledge and the necessary supplies for the after graduating life.
Last but not least, I want to thank my wife Eleni for being there and offering me the best present a human can ever a get, our unborn child.

Keywords: R&D Investments, Tax Aggressiveness, Biotechnology, R&D Expenses

Sotiris Gkegkas
02/05/2020

Contents

Introduction

Tax Aggressiveness or Tax Avoidance is a major problem faced by any government and society all over the world. According to International Monetary Fund (therefore IMF) one of the major problems every national economy is facing is the par economy, which hide and laundry money from terrorist action, violence, trafficking etc. But Tax aggressiveness is a major problem which someone can easily identify in almost any small, big or huge firm all over the world.

In this study I will try to examine if Biotechnology firms with R&D active departments, which invest any amount of cash, either from own capital or from debt or bonds, actually invest for R&D purposes or they just invest for accounting reasons. Biotechnology sector is the one with highest amount of investment in R&D departments, this because the higher spending in the first year of a new project, is equal to higher expectations of success of the project meaning maximization of profits and market value of the firm. According to DiMasi, Grabowski and Hansen (DiMasi, Grabowski, and Hansen 2016) it takes over $850mill to fully develop a product. Taking into considerations the studies of Markarian, Nelson and Cazavan (Markarian, Pozza, and Prencipe 2008)(Nelson, Elliott, and Tarpley 2003)(Cazavan-Jeny, Jeanjean, and Joos 2011), which lead to the conclusion that for earnings management purposes R&D investments would be capitalized. A definition, from Chen et al, I took under consideration for Tax Aggressiveness in this thesis is “downward management of taxable income through tax planning activities”(Chen et al. 2010). It includes the sum of meaning someone could give for Tax Aggressiveness and the major goal for at least a few Chief Executive Officer (CEO) or Chief Financial Officer (CFO), (Halioui, Neifar, and Abdelaziz 2016) as Halioui, Neifar and Abdeladiz stated.

It is know that for a company to be sustainable it should also be innovative and for a company to be innovative, big if not huge amount of funding should be driven to R&D departments. Taking that in consideration I will try to investigate if R&D expenses are correlated/ related with Tax Aggressiveness.

With all the above being said the thesis is about R&D expenses and accounting treatment. According to Mustafa Ciftci, Nan Zhou (Ciftci and Zhou 2014) disclosing R&D expenses in Financial Statements could possibly improve the value relevance.

Almost 34.4% of the listed US firms operate a R&D Department (Hernández 2010). Because every state has an obligation to retrieve money lost from Tax Aggressiveness or “accidentally” wrong Tax Planning, the US has imposed a corporate Tax of 21% flat since 01.01.2018 (Wikipedia). However every State has the right to form the Tax Rate on will. In this study I tried to focus on the biotech industry. It inccludes all the USA publicly listed Biotechnology firms with tf ICB Industry 4000, tf ICB Subsector 4573, Current Currency USD and Primary SIC Code 1311, 2111, 2384, 2833, 2834, 2835, 2836, 2873, 2911, 3826, 3841, 3845, 4522, 4731, 6726, 6794, 7372, 7374, 7375, 7389, 7812, 8069, 8071, 8093, 8731 and 8732. Data has been collected for Fiscal Years 2017-2018 and 2018-2019. Sample apparts from 378 firms. All the for mentioned are a hypo industry of the Health Care Industry from the publicly listed companies in the USA.

The outcomes I expect to have from the thesis and the research will improve the field of the existing evidence for this particular topic and will add the delivered results to the already existing ones. Furthermore, with the financial crisis we are all preparing to get in, because of the effects of Covid-19 as Kilpatrick from Deloitte stated (Kilpatrick 2020), I hope that the results will contribute to the minimum for economic wellness overcome purposes.

Last, the construction of the thesis is as follows, introduction is the first chapter, literature review and hypothesis development construct the second chapter, in the third chapter included the empirical analysis and the outcomes and lastly the conclusions.

Literature Review & Hypothesis Development

Chapter Literature Review & Hypothesis Development I exhibit the scientific outcomes from published paper and other internet sources which either agree and support the main hypothesis or disagree with it. Furthermore, I present the construction of the regression model and the connection I made between Tax Aggressiveness and R&D Expenses.

Tax Aggressiveness

"Downward management of taxable income through tax planning activities" (Chen et al. 2010), as I mentioned already in the abstract part of the thesis, but there are more definitions for Tax Aggressiveness from researchers that is why Tax Aggressiveness can also be referred as Tax Avoidance or Tax Evasion. One of the crucial factors to measure Tax Aggressiveness and more important its parameters is to determine both (Shackelford and Shevlin 2001).

One of the major disadvantages of R&D Investments is the high cash outflows, which could create liquidity problems in an unstable environment, for small firms Hao and Jaffe 1993; Mancusi and Vezulli 2010 (Hao and Jaffe 1993) (Mancusi and Vezzulli 2010).

R&D Investment

Taking in consideration Jin et al in the year 2018 and other related researchers (Jin, Shang, and Xu 2018)(Lev and Sougiannis 1996)(Reynard 1979)(Xu and Sim 2018), who said that there is a positive correlation between R&D and the economical performance a company has in markets which emerge. Studies has shown that earnings increase is associate with R&D Investing, as (Lev and Sougiannis 1996) stated. Forty five years earlier (Reynard 1979) researched and actually proved that there is a correlation between cutting down R&D Investments and lower earnings. As a result someone could easily be lead to the thought that a firm with low liquidity and R&D Investments

could apply Tax Avoidance/Aggressiveness. Tax Aggressiveness could be driven either from Top Management Executives for self-interest reasons or from liquidity problems.

Hypothesis Development

Hypothesis 1

The most significant elements for detecting Tax Aggressiveness are profitability, debt ratios, firm size, Big4 auditor, ROA and Market Book Value. All these financial elements have been tested from various other studies from various researchers and have already proved the correlation between R&D Investments and Tax Aggressiveness. As Clive S Lennox, Wanfu Li, Bin Lin & Zi-Tian Wang (Lennox et al. 2015) said it is more usable to find firms with low R&D Investments avoid Tax and to be more Tax Aggressive than firms with high R&D Investments. In the late 90s Aboody and Lev (Aboody and Lev 1998), proved a positive correlation between R&D capitalization and profitability and firm size, for software capitalization of course, but it is also an Intangible Asset just as R&D Investments. Almost twenty years after, in August 2008 a study (Oswald 2008), Dennis R. Oswald, whose research came in contrast with research made in the USA and proved at least for the UK firms that firms in steady-state has to expect only low gains when talking about worth associates when try to modify the book value of equity and already reported earnings for capitalized digits. All these in a state where R&D Expenditures and equal to the depreciation. Oliveira, Magnani, Tortoli, Figari, Ambrozini 2019 (Oliveira et al. 2019), proved that R&D expenses are Investment with long time payback, which means that for the executives it is not always easy to decide whether to see them as Intangibles Assets and conclude them in the Financial Statements or to treat them as R&D Expenses and capitalize them. One more study from Xuemeng Guo, Zhuojun Wang, Chang Liu (Liu, Guo, and Wang 2019) took under investigation the firms performance and the R&D intensity, so they proved that firms with high R&D expenses have higher Operating Income, which gives a whole new look to the side I am trying to see and investigate the hole subject. Furthermore (Yüksel 2017) conclude that there is not relationship among Research and Development and Financial Growth. According to Doukas and Switzer (Doukas and Switzer 1992) with the Study The Stock Market's Valuation of R&D Spending and

Market Concentration 1992, proved that 1 unit of money spent as R&D Investment has actually more value if spent by a big firm, than if it was spent by a smaller firm In this study I will try to connect R&D Investments with Tax Aggressiveness for Biotechnology Firms. As Namryoung Lee proved in 2018 (Lee 2018), it is more likely for biotechnology firms to expect more profits from the success of the development and commercial gains anew product could create than to actually waist it and capitalize it before its finished for liquidity or other reasons. In the same research it is also proven that the for mentioned behavior is only me in biotechnology industry sector, thus could drive us to the guesstimate that a biotechnology firm act like that, because of the passion the researchers have and future opportunities. From all the above I make the following hypothesis,

Hypothesis1: R&D Investments are negatively correlated with Tax Aggressiveness in Biotechnology Industry Sector.

Hypothesis 2

As usual in life, the same here there is the contrast opinion which implies that there is no negative correlation between R&D Investments and Tax Aggressiveness, meaning that a firm will strategically use R&D Expenses for Tax Avoidance reasons, because R&D Expenditures are Tax deductable as (Stickney and McGee 1982) said. Taking in consideration new factor the Cash Effective Tax Rates CETR (Gupta and Newberry 1997) appointed a non positive relationship with R&D expenses. One more factor is the Effective Tax Rate, which react in negative with R&D Intensity, which is calculated by dividing Sales to R&D Expenditures, as (Richardson and Lanis 2007) proved. According to one of the conclusions that (Hall et al. 2016) from a research contacted for the hole of the European Union, state that there are some cases where firm uses the R&D tax credits in order to speed Research instead of equal moving Research and Development, implicating that there is a way for some firms to benefit from Tax Aggressiveness by implying R&D Investments. Last but not least, the study (Huang, Krull, and Ziedonis 2020), showed that firms with multinational R&D Expenses have a significant degree of implying Tax Aggressiveness, while companies could reach higher

levels of tax efficiency Research and Development Invests when decreasing un-tax frictions pocked from non strong intellectual ownership secured nad when non decreasing the tax utilities earned from foreign Research and Development.

For the Hypothesis 2 and taking in consideration all the above. I will basically reverse Hypothesis 1 and presented as follows,

Hypothesis2: R&D Investments are positively correlated with Tax Aggressiveness in Biotechnology Industry Sector.

Research Design

The Chapter Research Design will actually analyze the methodology, which will be used to try proving either one of the two Hypotheses, it will also explain the reason why the variables depended and not have been chosen and the explanation of them.

Sample

To run the proccess of trying to prove either one of the two Hypothesis i have create a sample, sample have been collected from ThomsonOne database, provided by the VPN from the International Hellenic University. It inccludes all the USA publicly listed Biotechnology firms with tf ICB Industry 4000, tf ICB Subsector 4573, Current Currency USD and Primary SIC Code 1311, 2111, 2384, 2833, 2834, 2835, 2836, 2873, 2911, 3826, 3841, 3845, 4522, 4731, 6726, 6794, 7372, 7374, 7375, 7389, 7812, 8069, 8071, 8093, 8731 and 8732. Data has been collected for Fiscal Years 2017-2018 and 2018-2019. Sample apparts from 378 firms. Data have been also collected from Annual Report Statements from firms sites. Data includes Key Ratios like ROA, ROE, quick Ratio, I have also collected Data Market Book Value, Number of Preffered Stocks, Leverage Size of the firms, Big4 Audit, R&D department existence and R&D to Sales , Sales. International Accounting Standards

(Olinda, Dossani, and Mcgeachin 2015) sets the accounting treatment of all taxable profits and losses, both national and foreign.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.152[a]	,023	-,029	,238742006486	,023	,440	6	112	,851	2,416

a. Predictors: (Constant), ws.Research And Development Expense, MkTBK, tf.Return On Assets, BiG4ad_Slope, Lev, SiZe

b. Dependent Variable: TAXAgg_ETR

Tax Aggressiveness/ Dependent Variable

Above the table showing the R, R Square and Adjusted R Square for Model 1, also the Standard Error of the Estimates, the R Square Change, the F Change, df1, df2 Significant F Change and the Durbin-Watson. We can also see that the Predictors the constant variables are the Research and Development Expenses, the Market to Book Value, the ROA, BIG4 Slope, Leverage and the Size of the company. Size of the company has been calculated as the deviation results from the Max Total Assets to the individual Total Assets of each firm.

BIG4 slope is a dummy variable which takes the price of 1 or 0 depdnding in the fact, if a firm is being audited from on of the BIG4 Auditing Firms.

Leverage is calculated as explained later likewise the Market to Book Value.

Tax Aggressiveness (TAXAgg) is the field of the Degree of Tax Aggressiveness exciding the boundaries of legal Tax Planning and overcoming the higher limis of Abusive Tax Planning. Actually entering the ilegal and Noncompliance ground of Tax Aggressiveness of commiting Fraud. Tax Aggressiveness.

From my research in the universe of scientific research bibliografy I have discovered that most of the researcers use the Effective Tax Rate ETR combined with the Book Tax Gap BTG as proxies to measure Tax Aggressiveness or Avoidnce. I will base my research on the published study of David A. Guenther published in August 2014 (Guenther 2018) who proved that someone can measure Tax Aggressiveness just by using ETR, while using BTD can consult with error measurement.

ETR can be easier truck down through databases and a better explanation can be provided from the IAS 12 (Olinda, Dossani, and Mcgeachin 2015) International Accounting Standard as formention. I will calculate ETR as the quotient of Total Tax Expenses (TTE) by the pre-Tax Income (pTIN)

ETR=TTE/pTI (Chen et al. 2010).

Independent Variables R&D_Inv

For the independent varible i have minned data from the database for R&D/Sales and multiply it with the ammount of Sales, so i can calculate the amount a firm spends for R&D Department. R&DtoSALES has also limitate the sample from 387 firms to 119 because not every firm of the starting Sample has an ongoing R&D Department.

Control Variables

For the Control Variables i have used priop research studies and based on their model i have collect the following Variable, which are ROA, Lev, MkTBk, SALES, PREFFERED STOCKS, BIG4AUD, SIZE Roman Lanis, Grant Richardson, Grantley Taylor (Lanis, Richardson, and Taylor 2017). Following i will explain why and how will I use those Varibles.

ROA

Return on Assets is a profitability Ratio measure which measures how profitable a firm is regarding its Assets. It is best to use when sample apart from same Industry firms. In this Research it has been retrieved from ThomsonOne DataBase. The formula to calculate ROA is dividing Net Income by Total Assets.ROA inform us for the efficiency any firm has related to its Assets and the ability to generate Profits from them. ROA should be used to compare firm of the same Industry, because of the different necessary conditions each kind of Industry works. For example as Service firm which sells Insurances does not need a high amount of Assets comparing to a Manufacturing Firm, for which High amount of Tangible Assets like, PPE and Raw Material are necessary to operate.

Leverage

Leverage is calculated by dividing Total Company Debt to Shareholder's Equity. Data have been retrived from Database ThomsonOne, seperately Long Term Debts and Total Assets. Leverage is used to specify the amount of debt that is financing the operations a firm operates. I have retrieved Total Assets and Total Liabilities and I will calculate it all in excel with a formula. Leverage Finance data have been retrieved also from ThomsonOne Database.

MkTBk

Market Book Value is calculated by dividing The market Value of Equity by the Book value of Equity. To calculate the Book-Value of a firm i will divide Assets by T.Liabilities

and for the Market-Value i will multiply Stock-Price with Number of Shares, all those data have been collectes from ThomsonOne Database. I will use this ratio to see if a firm under research is over or under-valued. The formula to calculate MarketBook=MarketCapitalization/NetBookValue, where NetBookValue=TotalAssets-TotalLiabilities.

BiG4ad

BiG4ad_Slope

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	30	24,2	24,2	24,2
	1	94	75,8	75,8	100,0
	Total	124	100,0	100,0	

Big 4 Audited is a dummy variable, which will be taking the prices of 1 if the firms are audited from one of the Big4 Auditing Companies (*Deloitte, Ernst & Young, KPMG and PriceWaterCoopers*) or the price 0 if the firm is audited from a different company. As seen in the table above a 75,8% (94 firms) of the firms, which appart the sample are being audited from either one of one of the Big4 Auditing Firms. On the other hand a percentage of 24,2% something less than the one third, is being audited from a non Big4 Auditing Firm. Data has also been retrived from TomsonOne Database and in a few cases from the Consolidated Balance Sheets and the Financial Statements the firms have posted on the web.

SiZe

Size i will calculate it as the divided outcome by dividing Total Assets from each firm by max Total Assets Of a Firm. I will run the regression forst in an excel spreadshet and the outcomes calculated in a new row will be used for the SPSS to run the regression model at the end. Size variable is used to check the proportion every firm stakes in comparison to the bigest firm of the sample. Data has also been collected from ThomsonOne Database and Compustat.

Regression Model

In order to examine if either one of my two Hypothesis are right or wrong i have to construct the regression mode. With the model i will try to check the Tax Aggressiveness of R&D Investments in Biotechnology Subindustry firms using the independed variables and the control variables, which as mentioned already are the R&D Expenses, ROA, Leverage, Market to Book Value, BIG4 Slope and Size respectively:

$$TAXAgg_{i,t}=a_o + \beta_1*ROA_{i,t} + \beta_2*Lev_{i,t} + \beta_3*MkTBk_{i,t} + \beta_4*BiG4ad_{i,t} +\beta_5*SiZe_{i,t} + \beta_6*R\&D\_Inv_{i,t} + \varepsilon_{i,t}$$

The indicators i and t define the firm and Fiscal Year respectively, while the α is the constant term. The ε is the error term and $\beta_{1,2,3,4,5,6,7}$ are slopes. In addition for the model TAXAggi,t Tax Aggressiveness is measured related to ETR.

To run the model I used Panel Data which were imported from an Excel file to SPSS. The method I used is the Ordinary Least Square OLS, which functions under the principle of least square, meaning minimization of the summary resulting the square of the differences among the noticeable depended variable from the data sample we use regarding the projected outcomes from the linear friction. I hope the outcome will provide the expected outcomes.

Empirical Analysis

Empirical Analysis is the fourth out of the five chapter this thesis have. In this chapter i will present and explain the results and outcomes. Tables including the results and outcomes, the autocorrelation matrix and statistic evidences will be presented. When trying to put into words the results or outcomes from the statistical anaysis throught SPSS of the Regression Model I have constructed. I must first review all the dependent and independent variables. Tax Agressiveness is figured as TAXAgg_ETR. The first table show us the Variables Entered/Removed for the regression to run, and explains that a. Dependent Variable is the Tax Aggressiveness and that b. All requested variables entered.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	ws.Research And Development Expense, MkTBK, tf.Return On Assets, BiG4ad_Slope, Lev, SiZe[b]		Enter

a. Dependent Variable: TAXAgg_ETR

b. All requested variables entered.

Empirical Analysis

Notes

Output Created		10-APR-2020 23:43:48
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	124
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.

Syntax		REGRESSION /DESCRIPTIVES MEAN STDDEV CORR SIG N /MISSING LISTWISE /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT TAXAgg_ETR /METHOD=ENTER tf.ReturnOnAssets BiG4ad_Slope SiZe MkTBK Lev ws.Research And Development Expense /SCATTERPLOT=(*ZRESID ,*ZPRED) /RESIDUALS DURBIN HISTOGRAM(ZRESID) NORMPROB(ZRESID).
Resources	Processor Time	00:00:01.36
	Elapsed Time	00:00:01.37
	Memory Required	3388 bytes
	Additional Memory Required for Residual Plots	880 bytes

The above table is the first outcome from the SPPSS Database Analytics. After importing all the data retrieved from the ThomsonOne Database provided by the VPN from the International Hellenic University. I click on Analyze, Regression and then to Linear. I set as dependent variable the Tax Aggressiveness and as independent variables the Return on Assets, the Big4 Slope, the SIZE, the Market to Book value and last the Leverage. In the spreadsheet of SPSS I have imported an excel file with all the data, which I retrieved from the database. I have also process some data to calculate the slopes and variables like SIZE which is actually the log of the Total Assets. I have divide all Total Assets from each company separate to the firms Total Assets with the maximum amount (in USD) Total Assets. In the database I have also included some more variables which at the end were not necessary for the regression model to run. I retrieved them for scientific reason and probably for another Study, which I will prepare.

Descriptive Statistics

	Mean	Std. Deviation	N
TAXAgg_ETR	-,06460136854	,235317174763	119
tf.Return On Assets	-67,40714285714	286,505069603867	119
BiG4ad_Slope	,76	,431	119
SiZe	,35	1,806	119
MkTBK	23,2914701668	196,91893095558	119
Lev	-,13735759245	3,385142315970	119
ws.Research And Development Expense	170,40	659,298	119

In the table above we can see the Mean, the Standard Deviation and the number of observations the sample apart from. As seen the mean value for Tax Aggressiveness is -0,6460136854, for Return on Assets is -67,40714285714 while for Big4 Slope is 0,76 for Size is 0,35 and for Market to Book Value is 23,2914701668, on the other hand for Leverage is -0,13735759245 and for Research and Development Expenses is 170,50.

On the third row of the table we see the Std Deviation which takes the prices of 0,235317174763 for Tax Aggressiveness, 286,505069603867 for ROA, 0,431 for BIG4_Slope, 1,806 for SiZe, 196,91893095558 for MkTNK, 3,385142315970 for Lev and 659,298 for Research And Development Expense. Last but not least the number of observation for the sample size is 119.

From the above table I cannot expect outcomes, which will provide reliable results to prove either one of the two for mentioned hypothesis.

Correlations

		TAXAgg_ETR	tf.Return On Assets	BiG4ad_Slope	SiZe	MkTBK	Lev	ws.Research And Development Expense
Pearson Correlation	TAXAgg_ETR	1,000	-,098	-,079	-,077	,027	-,047	-,081
	tf.Return On Assets	-,098	1,000	-,001	,051	,008	,008	,051
	BiG4ad_Slope	-,079	-,001	1,000	,104	,042	-,019	,128
	SiZe	-,077	,051	,104	1,000	-,014	,115	,882
	MkTBK	,027	,008	,042	-,014	1,000	,063	-,017
	Lev	-,047	,008	-,019	,115	,063	1,000	,119
	ws.Research And Development Expense	-,081	,051	,128	,882	-,017	,119	1,000
Sig. (1-tailed)	TAXAgg_ETR		,144	,197	,204	,386	,307	,192
	tf.Return On Assets	,144		,494	,291	,466	,467	,290
	BiG4ad_Slope	,197	,494		,131	,323	,420	,083
	SiZe	,204	,291	,131		,438	,107	,000
	MkTBK	,386	,466	,323	,438		,248	,427
	Lev	,307	,467	,420	,107	,248		,098
	ws.Research And Development Expense	,192	,290	,083	,000	,427	,098	
N	TAXAgg_ETR	119	119	119	119	119	119	119
	tf.Return On Assets	119	119	119	119	119	119	119
	BiG4ad_Slope	119	119	119	119	119	119	119
	SiZe	119	119	119	119	119	119	119
	MkTBK	119	119	119	119	119	119	119
	Lev	119	119	119	119	119	119	119

	ws.Research And Development Expense	119	119	119	119	119	119	119

In the correlation matrix we can see the coefficient correlation between two variables; it is the Pearson pair wise model. What we can actually see is how significant is one variable in comparison to another, that's why when comparing the same variable the result is always 1.SiZe to SiZe 1, Lev to Lev 1, BiG4ad_Slope to BiG4ad_Slope 1, Tax Aggressiveness to Tax Aggressiveness 1, ROA to ROA 1, R&D Expenses to R&D Expenses 1. The total number of the firm under investigation is equal to 119. What I can see from the correlation matrix above is that there is a correlation significance between SiZe and Research And Development Expense, which is lower than the 0,01 actually is less than that and equal or less 0,000. The rest of the variables are not significant because none is lower that either 0,05 or 0,01. I can also see in the Pearson pair wise correlation that the variables Big4_Slope and ROA are correlated, as is ROA with Market to Book Value and Leverage. There is also a noticeable significance among Big4_Slope and ROA and Market to Book Value, this can be explained from the matrix. So SPSS has actually run all the variables to each other and justified the correlation among them all.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	-,037	,045		-,834	,406	-,126	,051		
	tf.Return On Assets	-7,812E-05	,000	-,095	-1,017	,311	,000	,000	,997	1,003
	BiG4ad_Slope	-,040	,051	-,074	-,780	,437	-,142	,062	,980	1,021
	SiZe	-,003	,026	-,023	-,117	,907	-,054	,048	,222	4,503
	MkTBK	3,864E-05	,000	,032	,345	,731	,000	,000	,993	1,007
	Lev	-,003	,007	-,042	-,444	,658	-,016	,010	,980	1,021
	ws.Research And Development Expense	-1,444E-05	,000	-,040	-,203	,839	,000	,000	,220	4,537

From the table above I can see that there is a statistical significance. I mean that my hypothesis according to the test is in the accepted areas, from the probability of

default tables I see that that my rejects region is from the values of -2,29 and 2,29. So all the results for the t which are -0,834 -1,017 -0,78 -0,117 0,345 -0,444 and -0,203 are in the accepted area or in the 95% of the accepted region. So I can accept my hypothesis that R&D Expenses/Investments are related with Tax Aggressiveness, BUT this is not the case for Biotechnology Companies. The reason why this is happening is unexplained from this thesis, but it could be an interesting field of research. According to the literature and guesses it could be because of the potential profits a firm biotechnology firm could have from the competences of a project. We can also notice that there is not a single one variable with a higher than 10 value at the Statistics VIF, which means that there is not a problem with the model. In the next step I will see at the Collinearity Diagnostics where in the Variance Proportions there is one problem with collinearity at the Leverage with price 0,92 and 0,91, which determines that there is a problem with the variable.

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions						
				(Constant)	tf.Return On Assets	BiG4ad_Slope	SiZe	MkTBK	Lev	ws.Research And Development Expense
1	1	2,398	1,000	,03	,01	,03	,02	,00	,00	,02
	2	1,548	1,245	,03	,07	,02	,04	,01	,04	,03
	3	1,042	1,517	,00	,00	,00	,00	,52	,40	,00
	4	,934	1,602	,00	,49	,00	,00	,20	,32	,00
	5	,836	1,693	,02	,42	,02	,01	,26	,24	,01
	6	,130	4,302	,92	,00	,91	,01	,00	,00	,01
	7	,112	4,635	,00	,00	,02	,93	,00	,00	,94

In the table above where the values in the second row 1-7 are, are the variables Tax Aggressiveness, ROA, Big4_Slope, SiZe, MkTBK, Lev and Research and Development Expenses respectively. In the Collinearity Diagnostics I check for prices over 0,9 there are two for Leverage. First one Leverage to Tax Aggressiveness and second one Leverage to BIG4_Slope. There is also one price over 0,9 R&D Expense to R&D Expense.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-,19664780796	,16389244795	-,06460136854	,035701786158	119

Residual	-1,711532711983	,575333952904	,000000000000	,232593110826	119
Std. Predicted Value	-3,699	6,400	,000	1,000	119
Std. Residual	-7,169	2,410	,000	,974	119
a. Dependent Variable: TAXAgg_ETR					

In the Residuals Statistics table I can see that the residual has a mean of 0 so we don't have to check it, the same goes for Std Predicted Value and for Std Residual.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,150	6	,025	,440	.851[b]
	Residual	6,384	112	,057		
	Total	6,534	118			
a. Dependent Variable: TAXAgg_ETR						
b. Predictors: (Constant), ws.Research And Development Expense, MkTBK, tf.Return On Assets, BiG4ad_Slope, Lev, SiZe						

In the ANOVA table we see that the significance is not even close statistical significance because it is not close to 0, but 0,851 the sample is homogenous. The higher the F score gets the lower the Significance will get. So almost 85,1% is the percentage that the hypothesis will happen.

Outcomes

From the empirical analysis and the run of the regression model, which was made in the SPSS program, I can see that there is a significance correlation. Meaning that the hypothesis 1 is accurate. So I can say that, R&D Investments are negatively correlated with Tax Aggressiveness in Biotechnology Industry Sector. In the Biotechnology Industry there is a negative correlation among R&D Investments and Tax Aggressiveness. This is happening because there is almost always a positive correlation between the expected outcomes of a product or a service which is still tested and researched (still in the R&D Department and no yet offered in the market), than the capitalization of a service or product before it is ready to be offered o the public for sale (Lee 2018). I think, that in Biotechnology Industry it would also be more detrimental for a company to either capitalize an R&D Project before it is ready for to be offered or to avoid taxes.

The first case, where an R&D Project is capitalized or canceled before it is complete, it would mean, that the firm is facing financial problems or that there is a shift of acts or plans, which could possibly have negative outcomes for the firm's financial performance and the way the stockholders and shareholders see the firm's future. On the other hand the scenario where R&D Investments are being made for Tax Avoidance reasons could have massive outcomes for a Biotechnology firm prestige.

When taking in consideration the research of Lee 2018 (Lee 2018) " R&D Accounting Treatment, R&D State and Tax Avoidance: With a Focus on Biotech Firms", who proved that Tax Avoidance and R&D Investments are not correlated meaning that when Tax Avoidance occurs, this is not the case for R&D Investments. As Dennis R. Oswald, in August 2008 said (Oswald 2008), whose research came in contrast with research made in the USA and proved at least for the UK firms that firms in steady-state has to expect only low gains when talking about worth associates when try to modify the book value of equity and already reported earnings for capitalized digits. As Oliveira and et al in 2019 (Oliveira et al. 2019) proved that R&D expenses are Investment with long time payback, which means that for the executives it is not always easy to decide whether to see them as Intangibles Assets and conclude them in the Financial Statements or to treat them as R&D Expenses and capitalize them. As Yüksel in 2017 (Yüksel 2017)

conclude that there is not relationship among Research and Development and Financial Growth. So, when parallelize the results of my research model and all the for mentioned researchers conclusions, but with a major respect to Lee 2018 I could come to the conclusion that my Hypothesis 1 is true and accepted.

Meaning that there is not a positive correlation between the R&D Investments and Tax Aggressiveness, for Biotechnology Industry in the USA publicly listed firms in the NASDAG.

Conclusions

Concluding the Thesis “R&D Investments and Tax Aggressiveness with a focus on Biotechnology Firms”. In the first chapter “Introduction” I explain the general fundamentals, which will follow. An explanation for Tax Aggressiveness is presented from Chen et al. and then a small summary of the sample like the Industry, Country, Sub Sector, SIC etc are given. In the second chapter “Literature Review & Hypothesis Development”, an explanation of the terms Tax Aggressiveness and R&D Investments are being made. A historical review of case studies and published paper are being exhibited to either support the Hypothesis1 “R&D Investments are negatively correlated with Tax Aggressiveness in Biotechnology Industry Sector”; and a same historical review follows to either vote against the first Hypothesis or, if can say, or to support the Hypothesis 2 “R&D Investments are positively correlated with Tax Aggressiveness in Biotechnology Industry Sector”. Almost 22 case studies apart the chapter 2.

In chapter 3 “Research Design” it concludes by the sample and the dependent and independent variables. Samples inccludes all the USA publicly listed Biotechnology firms with tf ICB Industry 4000, tf ICB Subsector 4573, Current Currency USD and Primary SIC Code 1311, 2111, 2384, 2833, 2834, 2835, 2836, 2873, 2911, 3826, 3841, 3845, 4522, 4731, 6726, 6794, 7372, 7374, 7375, 7389, 7812, 8069, 8071, 8093, 8731 and 8732. Data has been collected for Fiscal Years 2017-2018 and 2018-2019. Sample apparts from 124 firms. Data have been also collected from Annual Report Statements from firms sites. Data includes Key Ratios like ROA, ROE, quick Ratio, I have also collected Data Market Book Value, Number of Preffered Stocks, Leverage Size of the firms, Big4 Audit, R&D department existence and R&D to Sales , Sales. International Accounting Standards. Tax Aggressiveness is the dependent variable of the regression model and R&D Investments is the indipendent variable. For calculating Tax Aggressiveness the Effective Tax Rate is computed andcalculated as he percentage of the Taxable Income divided by the Income Payable Taxes. To calculate R&D Investments because in the beginning of the research it was not clear from the databases and the Internet sites of the firms under investigations, if there was an active R&D Department. Data for R&D Sales, R&D Expenses, Sales to R&D were

collected, by the end of the day throught Compustat R&D Investments were mined and used to run the regression model. As control variables i used the ratios and logs Return On Assets, Size of the Firm, Market to Book Value, Big4 Slope and Leverage. All data were collected from ThomsonOne database with access given throught the VPN of the International Hellenic University. Variables like Big4 are Dummy Variable, which took prices of 1 if firms where audited by one of the Big 4 Auditing Firms (Delloite, PWC, KPMG, EY); and the price of 0 if any other Auditing Firm where to audit the firms under investigation. Variables like Size is the result of the deviation of Total Assets of a form devided by the Total Asset of the Firm with the Maximum Ammount of Total Assets. Leverage variable is also mine throught the database ThomsonOne and in a few cases from the online posted Financial Statements from the firm websites. Market to Book Value was calculated as the Market Capitalization devide by Net Book Value, where Market Capitalization is the Number of Stocks multiplied with the Current Stock Price; and Net Book Value is the result of Total Assets minus Total Liabilities, data where also retrieved from ThomsonOne database. Last but not least, the Regression Model was build, set and ready to run in the SPSS.

In the next Chapter “Empirical Analysis”, the outcomes of the SPSS are presented. The tables of Variables Entered/Removed, Notes, Correlation, Coefficients, Collinearity Descriptive Statistics, Residual Descriptives, Collinearity Diagnostics and ANOVA are content and explained in the Chapter. From the for mentioned tables the Hypothesis 1 “R&D Investments are negatively correlated with Tax Aggressiveness in Biotechnology Industry Sector”, is slightly moving to the accepted area. As outcomes and conclusions after running the regression model and finishing the research, I can say that it is not accepted to say that there is a relationship, of any kind, between R&D Investments and Tax Aggressiveness, in the Biotechnology Industry for the publicly listed Biotechnology firms in the NASDAG. The hypothesis 1 “R&D Investments are negatively correlated with Tax Aggressiveness in Biotechnology Industry Sector”.

Last but not least, and after completing this research some new and very interesting fields to research come to my notice. A few of them are the Tax Aggressiveness and R&D Investments in democratic (west) countries in contrast to the Tax Aggressiveness and R&D Investments in a non-democratic (east) country. One more really interesting topic about Tax Aggressiveness is the par economy, and how in some cases it is

practically allowed by the auditing committees of some countries. Finally, I would like to try research the effectiveness of the cash being driven to the R&D Departments, and the correlation among Tax Return from R&D Investments in countries like Philippines, where the Tax Return rate is and used to be much more advantageous, according to EY ("Worldwide" 2018).

Bibliography

Aboody, David, and Baruch Lev. 1998. “The Value Relevance of Intangibles: The Case of Software Capitalization.” *Journal of Accounting Research* 36: 161. doi:10.2307/2491312.

Cazavan-Jeny, Anne, Thomas Jeanjean, and Peter Joos. 2011. “Accounting Choice and Future Performance: The Case of R&D Accounting in France.” *Journal of Accounting and Public Policy* 30 (2): 145–65. doi:10.1016/j.jaccpubpol.2010.09.016.

Chen, Shuping, Xia Chen, Qiang Cheng, and Terry Shevlin. 2010. “Are Family Firms More Tax Aggressive than Non-Family Firms?” *Journal of Financial Economics* 95 (1): 41–61. doi:10.1016/j.jfineco.2009.02.003.

Ciftci, Mustafa, and Nan Zhou. 2014. “Capitalizing R&D Expenses Versus Disclosing Intangible Information.” *SSRN Electronic Journal*. doi:10.2139/ssrn.2448957.

DiMasi, Joseph A., Henry G. Grabowski, and Ronald W. Hansen. 2016. “Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs.” *Journal of Health Economics* 47: 20–33. doi:10.1016/j.jhealeco.2016.01.012.

Doukas, John, and Lorne Switzer. 1992. “The Stock Market’s Valuation of R&D Spending and Market Concentration.” *Journal of Economics and Business* 44 (2): 95–114. doi:10.1016/0148-6195(92)90009-Y.

Guenther, David A. 2018. “Measuring Corporate Tax Avoidance: Effective Tax Rates and Book-Tax Differences.” *SSRN Electronic Journal*. doi:10.2139/ssrn.2478952.

Gupta, Sanjay, and Kaye Newberry. 1997. “Determinants of the Variability in Corporate Effective Tax Rates: Evidence from Longitudinal Data.” *Journal of Accounting and Public Policy* 16 (1): 1–34. doi:10.1016/S0278-4254(96)00055-5.

Halioui, Khamoussi, Souhir Neifar, and Fouad Ben Abdelaziz. 2016. “Corporate Governance, CEO Compensation and Tax Aggressiveness: Evidence from American Firms Listed on the NASDAQ 100.” *Review of Accounting and Finance*. doi:10.1108/RAF-01-2015-0018.

Hall, Bronwyn H., Pietro Moncada-Paternò-Castello, Sandro Montresor, and Antonio Vezzani. 2016. “Financing Constraints, R&D Investments and Innovative Performances: New Empirical Evidence at the Firm Level for Europe.” *Economics of Innovation and New Technology*. doi:10.1080/10438599.2015.1076194.

Hao, Kenneth Y., and Adam B. Jaffe. 1993. “Effect of Liquidity on Firms’ R&d Spending.” *Economics of Innovation and New Technology* 2 (4): 275–82. doi:10.1080/10438599300000008.

Hernández, Héctor. 2010. “The 2010 EU Industrial R&D Investment SCOREBOARD Joint Research Centre European Commission.” http://www.eurosfaire.prd.fr/7pc/doc/1314352259_sb_2010_bxl_17_11_2010.pdf.

Huang, Jing, Linda Krull, and Rosemarie Ziedonis. 2020. “R&D Investments and Tax Incentives: The Role of Intra-Firm Cross-Border Collaboration.” *Contemporary Accounting Research*. doi:10.1111/1911-3846.12588.

Jin, Zhenji, Yue Shang, and Jian Xu. 2018. “The Impact of Government Subsidies on Private R & D and Firm Performance: Does Ownership Matter in China’s Manufacturing Industry?” *Sustainability (Switzerland)* 10 (7). doi:10.3390/su10072205.

Kilpatrick, Jim. 2020. “COVID-19 Managing Cash Flow during a Period of Crisis,” 10. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/gx-COVID-19-managing-cash-flow-in-crisis.pdf.

Lanis, Roman, Grant Richardson, and Grantley Taylor. 2017. “Board of Director Gender and Corporate Tax Aggressiveness: An Empirical Analysis.” *Journal of Business Ethics* 144 (3): 577–96. doi:10.1007/s10551-015-2815-x.

Lee, Namryoung. 2018. “R & D Accounting Treatment, R & D State and Tax Avoidance: With a Focus on Biotech Firms.” *Sustainability (Switzerland)* 11 (1). doi:10.3390/su11010044.

Lennox, Clive S., Wanfu Li, Bin Lin, and Zi-Tian Wang. 2015. “Tax Aggressiveness, R&D Spending, and Firmss Claims for R&D Tax Deductions: Evidence from China.” *SSRN Electronic Journal*. doi:10.2139/ssrn.2574519.

Lev, Baruch, and Theodore Sougiannis. 1996. “The Capitalization, Amortization, and Value-Relevance of R&D.” *Journal of Accounting and Economics* 21 (1): 107–38. doi:10.1016/0165-4101(95)00410-6.

Liu, Chang, Xuemeng Guo, and Zhuojun Wang. 2019. “R&D Expenses and Operating Performance in Pharmaceutical Industry” 2: 214–19. doi:10.35532/jsss.v2.039.

Mancusi, Maria Luisa, and Andrea Vezzulli. 2010. “R&D, Innovation and Liquidity Constraints.” *Policy*, 1–31.

Markarian, Garen, Lorenzo Pozza, and Annalisa Prencipe. 2008. “Capitalization of R&D Costs and Earnings Management: Evidence from Italian Listed Companies.” *International Journal of Accounting* 43 (3): 246–67. doi:10.1016/j.intacc.2008.06.002.

Nelson, Mark W., John A. Elliott, and Robin L. Tarpley. 2003. “How Are Earnings Managed? Examples from Auditors.” *Accounting Horizons*. doi:10.2308/acch.2003.17.s-1.17.

Olinda, Gustavo, Jawaid Dossani, and Anne Mcgeachin. 2015. “IAS 12 Income Taxes.” *IFRS Essentials* 44 (0): 91–109. doi:10.1002/9781119207917.ch8.

Oliveira, Amabele M., Vinícius M. Magnani, Júlia P. Tortoli, Anelise K.P. Figari, and Marcelo A. Ambrozini. 2019. “The Relationship between R&D Expenses and the Abnormal Return in Brazilian Firms.” *Revista de Administracao Mackenzie* 20 (5). doi:10.1590/1678-6971/eRAMF190106.

Oswald, Dennis R. 2008. “The Determinants and Value Relevance of the Choice of Accounting for Research and Development Expenditures in the United Kingdom.” *Journal of Business Finance and Accounting* 35 (1-2): 1–24. doi:10.1111/j.1468-5957.2007.02060.x.

Reynard, E. L. 1979. “A Method for Relating Research Spending to Net Profits.” *Research Management* 22 (4): 12–14. doi:10.1080/00345334.1979.11756546.

Richardson, Grant, and Roman Lanis. 2007. “Determinants of the Variability in Corporate Effective Tax Rates and Tax Reform: Evidence from Australia.” *Journal of Accounting and Public Policy* 26 (6): 689–704. doi:10.1016/j.jaccpubpol.2007.10.003.

Shackelford, Douglas A., and Terry Shevlin. 2001. “Empirical Tax Research in Accounting.” *Journal of Accounting and Economics* 31 (1-3): 321–87. doi:10.1016/S0165-4101(01)00022-2.

Stickney, Clyde P., and Victor E. McGee. 1982. “Effective Corporate Tax Rates the Effect of Size, Capital Intensity, Leverage, and Other Factors.” *Journal of Accounting and Public Policy* 1 (2): 125–52. doi:10.1016/S0278-4254(82)80004-5.

“Worldwide.” 2018.

Wikipedia

Xu, Jian, and Jae Woo Sim. 2018. “Characteristics of Corporate R & D Investment in Emerging Markets: Evidence from Manufacturing Industry in China and South Korea.” *Sustainability (Switzerland)* 10 (9). doi:10.3390/su10093002.

Yüksel, Serhat. 2017. “The Impacts of Research and Development Expenses on Export and Economic Growth.” *International Business and Accounting Research Journal* 1 (1): 1. doi:10.15294/ibarj.v1i1.1.

Appendix

TAXAgg_ETR					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1.789473684	1	,8	,8	,8
	-.848766131	1	,8	,8	1,6
	-.747018970	1	,8	,8	2,4
	-.522256685	1	,8	,8	3,2
	-.439065389	1	,8	,8	4,0
	-.434782609	1	,8	,8	4,8
	-.414783463	1	,8	,8	5,6
	-.410429695	1	,8	,8	6,5
	-.399792202	1	,8	,8	7,3
	-.396957207	1	,8	,8	8,1
	-.378378378	1	,8	,8	8,9
	-.335025381	1	,8	,8	9,7
	-.281690141	1	,8	,8	10,5
	-.269470405	1	,8	,8	11,3
	-.262864426	1	,8	,8	12,1
	-.234834999	1	,8	,8	12,9
	-.234741548	1	,8	,8	13,7
	-.209960938	1	,8	,8	14,5
	-.164194694	1	,8	,8	15,3
	-.156385752	1	,8	,8	16,1
	-.129725581	1	,8	,8	16,9
	-.129253229	1	,8	,8	17,7
	-.115384615	1	,8	,8	18,5
	-.056084656	1	,8	,8	19,4
	-.055335968	1	,8	,8	20,2
	-.044665516	1	,8	,8	21,0
	-.024635433	1	,8	,8	21,8
	-.011843079	1	,8	,8	22,6
	-.011815252	1	,8	,8	23,4
	-.007657596	1	,8	,8	24,2
	-.000827454	1	,8	,8	25,0
	-.000801282	1	,8	,8	25,8
	-.000241022	1	,8	,8	26,6
	-.000168698	1	,8	,8	27,4
	.000000000	1	,8	,8	28,2
	.000000001	72	58,1	58,1	86,3
	.000164465	1	,8	,8	87,1

	.000425279	1	,8	,8	87,9
	.000468274	1	,8	,8	88,7
	.000488162	1	,8	,8	89,5
	.002050815	1	,8	,8	90,3
	.003323837	1	,8	,8	91,1
	.005054354	1	,8	,8	91,9
	.006124722	1	,8	,8	92,7
	.008294931	1	,8	,8	93,5
	.008438819	1	,8	,8	94,4
	.015382558	1	,8	,8	95,2
	.043623229	1	,8	,8	96,0
	.044939429	1	,8	,8	96,8
	.068296216	1	,8	,8	97,6
	.362626055	1	,8	,8	98,4
	.380460037	1	,8	,8	99,2
	.544561934	1	,8	,8	100,0
	Total	124	100,0	100,0	

BiG4ad_Slope

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	30	24,2	24,2	24,2
	1	94	75,8	75,8	100,0
	Total	124	100,0	100,0	

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.152[a]	,023	-,029	,238742006486	,023	,440	6	112	,851	2,416

a. Predictors: (Constant), ws.Research And Development Expense, MkTBK, tf.Return On Assets, BiG4ad_Slope, Lev, SiZe

b. Dependent Variable: TAXAgg_ETR

ETR=TTE/pTI (Chen et al. 2010); where,

ETR: Effective Tax Rate,

TTE: Total Tax Expenses, and

pTI: pre-Tax Income

MarketBook=MarketCapitalization/NetBookValue; where,

Market Capitalization= Number of Stocks*Current Stock Price (13th April 2020)

NetBookValue=TotalAssets-TotalLiabilities.

$TAXAgg_{i,t}=a_o + \beta_1*ROA_{i,t} + \beta_2*Lev_{i,t} + \beta_3*MkTBk_{i,t} + \beta_4*BiG4ad_{i,t} +\beta_5*SiZe_{i,t} + \beta_6*R\&D\_Inv_{i,t} + \varepsilon_{i,t}$:where,

TAXAgg: Tax Aggressiveness,

ROA: Return On Assets,

Lev: Leverage,

MkTBk: Market to Book Value,

BiG4ad: Big 4 Auditor,

SiZe: Size of the firm, and

R&D_Inv: R&D Investments